PATENT ABSTRACTS OF JAPAN

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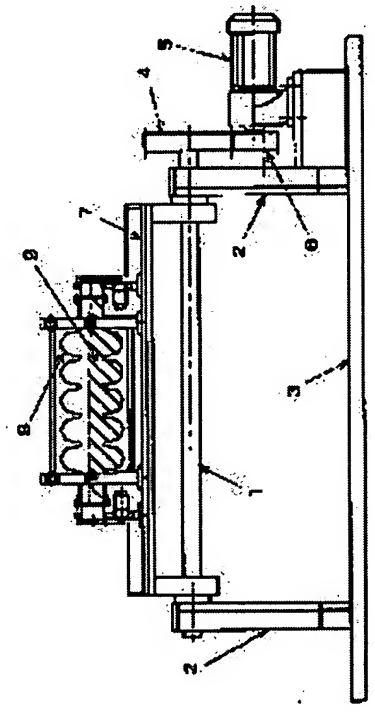
(54) INNER SURFACE POLISHING METHOD FOR HOLLOW BODY

(57)Abstract:

PROBLEM TO BE SOLVED: To extremely increase polishing removed amount and allow short time polishing by partially filling polishing media into inner space of a hollow body, rotating the hollow body itself, and revolving the hollow body around a revolution axis spaced from a rotation axis of the hollow body in the direction opposite to the rotation direction.

SOLUTION: A rotation mechanism of a hollow body 8 is loaded on a rotational table 7. The inner space of the hollow body 8 is filled with polishing media 9. The longitudinal both ends of the hollow body 8 are journalled to a bearing via sleeves. By adding rotation force from a motor via a bearing for transmitting power in the rotation mechanism, the hollow body 8 is rotated around a rotation axis. Rotation of the motor 5 rotates a revolution axis 1, the rotational 7 is largely rotated around the revolution axis 1, the hollow body 8 is revolved around the revolution axis 1 oppositely to the rotation direction, and thereby the inner surface of the hollow body 8 is physically polished.



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CLAIMS

[Claim(s)]
[Claim 1] The inside polish approach of the hollow object which is that the rotation direction makes a hollow object revolve around the sun to hard flow centering on the revolution shaft which is separated from the rotation shaft of a hollow object, filling up the building envelope of a hollow object with polish media partially, and making a hollow object rotate, and is characterized by grinding the inside of a hollow object physically.
[Claim 2] A hollow object is the inside polish approach of the hollow object according to claim 1 which is a tubular object which has opening to both ends at least, and is characterized by setting the rotation shaft of a hollow object as the medial axis of this tubular object.
[Claim 3] It is the inside polish approach of a hollow object according to claim 1 or 2 that the revolution shaft of a hollow object is set as an abbreviation horizontal direction, and the rotation shaft of a hollow object is characterized by a setup or receiving horizontally and carrying out both-way tilt periodically to an abbreviation horizontal direction.
[Claim 4] The inside polish approach of the metal hollow object characterized by grinding the inside of a metal hollow object physically by filling up partially with polish media the building envelope of the metal hollow object which has at least one weld, and making turning effort, vibration, or a centrifugal force act on a metal hollow object.
[Claim 5] A hollow object is the inside polish approach of the hollow object according to claim 1 to 4 characterized by consisting of stainless steel, titanium, niobium, aluminum, or copper.
[Claim 6] The abrasive grain with which polish media consist of a kind of a diamond, silicon carbide, an alumina, and a bauxite thru/or more than it at least, and vitrified ** are the inside polish approach of the hollow object according to claim 1 to 4 characterized by consisting of a binder which consists more than of a kind of resin.
[Claim 7] Polish media are the inside polish approaches of the hollow object according to claim 1 to 4 characterized by consisting of a kind of the wafer of the polish stone chosen from the shape of the shape of a cylindrical shape, a cone configuration, and a triangle, and a diamond configuration thru/or more than it.
[Claim 8] The inside polish approach of the hollow object according to claim 1 to 4 characterized by filling up the building envelope of a hollow object more than with a kind of water, a surfactant, and alkali partially at least as a polish assistant with polish media.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Although this invention can apply only the inside of a hollow object also to a simple cylindrical hollow object about the approach of grinding physically, it is useful to especially inside polish of the variant metal hollow object with which the center section of the cylindrical shape swelled like a superconduction acceleration cavity.
[0002]
[Description of the Prior Art] In the case of the bit and piece which cannot carry out buffing of every article from the former, put in polish media and many bits and pieces in the container of the hollow which carried out six rectangular pipes thru/or 8 rectangular-pipe configuration called a barrel, a centrifugal force is made to act on turning effort or an oscillating pan at a barrel, and there is the approach of grinding by ******(ing) a bit and piece with polish media. However, this approach might present the problem of polish sagging generating of the part into which the size of the components which can be held in a barrel must not carry out polish processing, and must not originally grind neither being restrained by the content volume size of a barrel, nor all the front faces that include the inside-and-outside side of components inevitably.
[0003] By the way, in manufacturing the superconduction acceleration cavity made from niobium used for acceleration of an elementary particle, bending, press working of sheet metal, engine-lathe processing, etc. are performed to this on the basis of tabular niobium material, and as shown in drawing 6 , it fabricates the pipe and the dished semicircle-like object as components. When components are pipes, electron beam welding of the comparison section is once carried out previously. Then, before setting and carrying out electron beam welding of these components, conventionally, it graduates, while removing a surface blemish, shaping Siwa, a surface crack, etc., and electron beam welding is carried out to the last, and it unites [buffing is once carried out in the phase of components, and] with it, and is making with the cavity. And in order to remove the spatter ball which dispersed and adhered at the time of welding while removing the weld bead of a joint after making with a cavity, inside local polish by the grinder is performed. That is, however it may carry out buffing in the phase of components, since electron beam welding is again carried out after that at the process which unifies components, a certain polish removal process for removing a weld bead etc. is indispensable. However, since some which carried out the unusually flat configuration depending on the cavity have the equatorial section, in a grinder, it may even be impossible to carry out inside polish. When the single cel cavity formed the multiple-string join and became like 5 cel cavities thru/or 9 cel cavities especially, removal of a weld bead and a spatter ball was impossible as a matter of fact.
[0004]
[Problem(s) to be Solved by the Invention] Also after carrying out weldbonding, and this invention's unifying with no grinding and using it as a metal hollow object, without grinding what point of that component with the means of buffing or others in advance It not only can remove the spatter ball which carried out physical polish only of the inside of a hollow object alternatively, and adhered with removal

and welding of a weld bead, but It is what is going to offer an effective means to remove and graduate Siwa of a surface of metal, a crack, etc. which were produced at the time of a metal scale or shaping. The local polish process after electron beam welding is abolished in the buffing process list in a components phase, and it aims at offering the inside polish approach of an effective remarkable hollow object also to the metal hollow object of the configuration in which the usual physical polish processing is impossible.

[0005]

[Means for Solving the Problem] this invention persons throw in much goods which should be ground to coincidence with polish media in the tubed container which carried out six rectangular pipes called the barrel known as the extensive polish approach of the front face of the bit and piece described as a Prior art thru/or 8 rectangular-pipe configuration. Although its attention was paid to the barrel polishing ground by giving rotation, vibration, etc., it became clear that it was inapplicable at all to the case of a metal hollow object, for example, the metal hollow object used for the superconduction acceleration cavity which consists of niobium material. That is, although manufactured through the very complicated process which consists of bending, press working of sheet metal, cutting, and electron beam welding by using the plate of niobium as a start ingredient in this case, it is limited to the inside which affects that engine performance, and the object part of carrying out polish processing of the external surface which should be graduated by physical polish is meaningless, and also useless. Furthermore, it is common to be many problems on the acceleration frequency band which is used in the case of an acceleration cavity, and a design etc., and for the size to come the direction to at least 1m or more at an overall length generally, and is not in the condition which can apply the polish technique called the conventional barrel finishing.

[0006] then, this invention persons as an approach of grinding physically the metal hollow object like the acceleration cavity which has opening to the both ends Partial packing of the polish media is carried out to the space part by making the cavity itself into a barrel. The occupancy volume of polish media [as opposed to / examine the effectiveness of the approach of rotating focusing on the axis of this hollow object in a detail, and / the content volume of a cavity], Rotational speed (engine speed), the existence of the reversal for every fixed period, the class and its size of polish media, Although the existence of a polish assistant (water, surfactant) etc. influenced the amount of polish removal, buffing for every components which were indispensable as a manufacture process of the acceleration cavity to the former could be deleted, and the prospect which can carry out [the prospect] electron beam welding suddenly and can be made into a cavity was acquired. However, when it took into consideration conventionally from the niobium thickness removed by buffing, or the need removal thickness of the bead after electron beam welding, becoming the continuation polish activity of the long duration which reaches at least on 9 or more for need polish removal thickness's estimating it as 50 micrometers or more, and attaining this inevitably was expected. Therefore, the technique which supplies polish media to the interior of a metal hollow object, and is ground physically is not permissible in cost to the industrial purpose of carrying out efficiently for a short period of time, even if there is the possibility.

[0007] The result of having used the tube made from niobium for polish verification designed and manufactured by the shape of a simple cylindrical shape as shown in drawing 8 , having set constant the capacity of the polish media supplied to the interior of a hollow object, and having carried out inside polish of continuation 24 hours about the factor with large effect in many factors related to above-mentioned inside physics polish becomes as it is shown in Table 1.

[0008]

[Table 1]

No	中空体内面への適用方法	中空体回転数	研磨メディア	研磨助剤	研磨除去厚	研磨除去重量
A	一方向の回転のみ	60rpm	PK-10	ナシ	0.7μm	0.215g
B	〃	90rpm	〃	ナシ	1.1μm	0.343g
C	〃	90rpm	〃	アリ	1.4μm	0.429g
D	〃	130rpm	〃	ナシ	1.2μm	0.360g
E	〃	90rpm	MXB	アリ	0.1μm	0.015g
F	〃	90rpm	SPT	アリ	2.3μm	0.643g
G	〃	90rpm	VRT	アリ	2.8μm	0.857g
H	〃	90rpm	PLD	アリ	3.5μm	1.072g
I	〃	90rpm	GRT	アリ	4.2μm	1.286g
J	反転を加えた周期的回転	90rpm	PK-10	アリ	3.5μm	1.063g
K	一方向回転+揺動	90rpm	〃	アリ	3.2μm	0.968g
L	反転を加えた回転+揺動	90rpm	〃	アリ	3.9μm	1.200g

In Table 1, the forward inversion of the tube made from niobium is carried out every 10 minutes with "periodic rotation which added reversal" of No.J. Moreover, to the shaft orientations of the tube made from niobium, "rocking" of No.K and No.L makes opening of both ends swing in the vertical direction, and is moved up and down a period for 2 minutes. The detail of polish media is as given in Table 2. In addition, in the case of a polish assistant ant, it is the same volume ****** as polish media about water and a surface active agent.

[0009]

[Table 2]

No	研磨メディア	メディア形状	チップサイズ	砥　粒	結合剤	メーカー
1	PK-10	円錐形	10mmφ	アルミナ	ポリエステル	TKX
2	MXB	球形状	6mmφ	〃	ビトリファイド	〃
3	SPT	三角柱	6mm×6mm	ボーキサイト	〃	〃
4	VRT	同上	15mm×10mm	アルミナ	〃	〃
5	PLD	円錐形状	10mmφ×17mm	ダイアモンド	ポリエステル	〃
6	GRT	三角柱	12mm×12mm	炭化ケイ素	ビトリファイド	〃

Analysis of the result obtained by continuation polish of 24 hours of Table 1 acquires the following knowledge. First, when No.A from which only the rotational frequency of a hollow object differs, and B and D are compared, it turns out that the one of the amount of polish removal where the rotational frequency of a hollow object is higher increases. However, since the improvement effect of the amount of polish removal is saturated even if it makes a rotational frequency higher than 90rpm, it can be said that 90rpm extent is an upper limit practically. Next, although the direction of the amount of polishes which exists rather than there is no polish assistant will increase 20 to 30% about the case of rotational frequency 90rpm if No.B and C are compared, it does not lead to compaction with operated days dramatic to this extent then. Next, when No.E-I which changed only polish media was seen on condition that No.B of engine-speed 90rpm and a polish assistant ant, it turned out that a result with best GRT is shown. Furthermore, when No.C was compared with No.J-L, by giving the periodic rotation or rocking which added reversal to the hollow object showed that the amount of polish removal increased by about about 2 times.

[0010] When it is the conditions of engine-speed 90rpm, a polish assistant ant, and the polish media GRT and the periodic rotation or rocking which added reversal to the hollow object further was given from the above thing, what the amount of polish removal of about 12 micrometers can be expected for in 24 hours was understood, but if the time amount taken to still grind 50 micrometers of need polish removal thickness is found, it will be called four days or more and is not realistic in cost. moreover, the setting (consumption, consumption) of the polish media supplied when continuation polish which attains to long duration was actually performed -- it is -- simple -- as predicted -- **** -- it also became clear that it did not become. Anyway, even if rotate a metal hollow object, it makes it rock or it changes the class of polish media, not being connected is clear to an improvement of the fast amount of polish

removal.
[0011] Then, giving rotation to a metal hollow object focusing on an axis, as a result of examining various the polish approaches which may increase the amount of polish removal dramatically When hard flow is made to carry out the circular motion of the hand of cut of the hollow object itself greatly by using as a reference axis the point which is separated from the axis of this hollow object in parallel and the centrifugal force was made to act, while polish media were forced on the internal surface of a hollow object, it is the friction operation and discovered that increase of the amount of polish removal could be measured remarkably.
[0012] Table 3 uses again the tube for the verification made from niobium shown in drawing 8 as a specimen for inside polish. Two kinds of PK-10 are selected as GRT which shows the best result in Table 1 as polish media, and its object for a comparison. The result of having fixed capacity of the polish media similarly supplied to the interior of the tube made from niobium, and having tried continuation inside polish of 24 hours is shown, and the amount of maximum polish removal about 4.5 times the amount of polish removal of having obtained in Table 1 is shown.
[0013]
[Table 3]

研摩メディア	空洞回転数	空洞公転回数	研摩助剤	研摩除去厚	研摩除去量
PK-10	90rpm	90rpm	表-1に同じ	17.8μm	5.401g
GRT	〃	〃	〃	52.8μm	24.301g

When Table 1 No.C Reached the result of Table 3, the dramatic improvement of single or more figures was made as compared with I and GRT was used as polish media, it turned out that the time amount which polish takes can be shortened less than on 1.
[0014]
[Embodiment of the Invention] Drawing 1 is the front view showing the whole equipment configuration for enforcing the polish approach of this invention, and drawing 2 is the right side view. Among drawing, one is a revolution shaft, near the both ends of a longitudinal direction is supported free [rotation] with the stand 2 of a pair, and the fixed angular table 3 is constructed the upper part and horizontally. The longitudinal direction end of the revolution shaft 1 is equipped with the gearing 4, and turning effort is received from the gearing 6 with which the motor 5 was equipped. The revolution shaft 1 is equipped with the rotary table 7. If the revolution shaft 1 rotates by rotation of a motor 5, a rotary table 7 will rotate greatly, as shown in the arrow head A of drawing 2 centering on the revolution shaft 1. An arrow head B is the rotation direction of a hollow object, and is set as hard flow with the revolution direction. c is the rotation shaft of a hollow object.
[0015] Drawing 3 is the front view showing the detailed configuration of the rotation device of the hollow object carried on a rotary table 7, and drawing 4 is the right side view. Among drawing, eight are a superconduction acceleration cavity which consists of a hollow object made from niobium, and have equipped with the thing of 5 ream structures here. The interior of the hollow object 8 is filled up with the polish media 9. The hollow object 8 is supported to revolve by bearing 10 through the sleeve 15 in the both ends of a longitudinal direction, and rotates around the rotation shaft c by being given turning effort from a motor 14 through the gearings 11, 12, and 13 for power transfer. In addition, 16 is a fixture for supporting a variant hollow object.
[0016] The inside of a hollow object can be physically ground by making a hollow object revolve around the sun to hard flow with the rotation direction centering on the revolution shaft which is separated from the rotation shaft of a hollow object, filling up the building envelope of a hollow object with polish media partially, and making a hollow object rotate, as shown in drawing 5 R> 5, if the equipment shown in this drawing 1 - drawing 4 is used.
[0017] (Example) To the inside of the superconduction acceleration cavity for engine-performance verification made from niobium used with the 1.3GHz frequency band shown in drawing 7 # the product name "GRT" which contains the silicon carbide of 220 as an abrasive grain, making it rotate focusing on the axis of an acceleration cavity, after throwing in 800cm 3 and 300ml of water, and a little surfactant

for polish media and covering opening of ** And with the hand of cut of a cavity, equipped the equipment which can be greatly rotated to hard flow, and set the rotational frequency of a cavity to 100rpm, in order to make a centrifugal force act, hard flow was made to rotate the whole cavity by 100rpm, and it continued for 24 hours. Then, when the cavity was removed, polish media, the metal powder which was able to be deleted were taken out and weighing capacity was washed, dried and carried out from equipment, there was a 85.2g weight decrease. It is 61.0 micrometers when it converts into the thickness which removed this. Moreover, when it divided finely the beam pipe section, the iris section, and near the equator and asked for partial polish removal thickness from residual thickness with the ultrasonic thickness plan, it is 21 micrometers, 49 micrometers, and 114 micrometers, respectively, and the iris section which influences the engine performance, and the equatorial section had become the polish removal thickness which may be satisfied as an acceleration cavity. Moreover, when surface roughness was measured about the beam pipe section, the smooth nature can be mostly satisfied with 1.8microRy of nature was also obtained. Furthermore, although the electron-beam-welding section of the iris section and the equatorial section was observed in the detail with the endoscope, it did not attach at all, and adhesion of a spatter ball was not seen, either, but the distinction with a weld zone and a non-weld zone had become a good polish result side.

[0018] thus, the superconduction acceleration cavity made from niobium by which physical polish was carried out in the inside -- continuing -- chemical polishing -- or although electrolytic polishing is carried out, how of the finishing condition of the cavernous inside in this phase influences the right and wrong of that engine performance. According to the physical polish approach of this invention, there is an advantage that the weld bead of the equatorial section can remove alternatively, therefore it becomes possible to be stabilized also economically and efficiently and to manufacture an acceleration cavity.

[0019] Moreover, the inside grinding method by this invention is altogether applicable, if polish media and polish conditions are selected even if metal hollow objects are aluminum, stainless steel, copper, and titanium. In addition, an inside is applicable to the inside polish of a nonmetal cavity by which metal plating was carried out.

[0020]

[Effect of the Invention] Since the inside of a hollow object was physically ground by filling up the building envelope of a hollow object with polish media partially, and giving rotation to a hollow object according to this invention If it applies when outside polish wants to be unnecessary and to grind only an inside alternatively As opposed to buffing for every components holding the trouble of a dust public nuisance, even if there is an advantage of being economical and it sees from work environment further, when especially a material is expensive in this invention Since the polish activity done physically is limited only to the interior of a hollow object, there are insurance and a big advantage of being clean, also as work environment.

[0021] Since it was made make a hollow object revolve around the sun to hard flow with the rotation direction especially centering on the revolution shaft which is separated from the rotation shaft of a hollow object according to invention of claim 1, making the hollow object itself rotate, the operation which forces polish media on the inside of a hollow object according to a centrifugal force works, the amount of polish removal increases by leaps and bounds by this, and it is effective in the ability to be able to grind in a short time. Moreover, according to claim 2 or invention of 3, while an operation of gravity and an operation of a centrifugal force can force polish media on the inside of a hollow object conjointly, attaching strength and raise polish effectiveness, it is effective in the ability to lessen polish unevenness.

[0022] Furthermore, at the same time it removes the spatter ball of welding which dispersed climax of an unescapable weld bead and near the weld zone, and adhered to the front face of a metal material according to invention of claim 4, when a metal hollow object is formed by weldbonding The metal scale of a hollow inside-of-the-body side, dirt, surface Siwa further produced at the time of a surface crack or molding processing, etc. can be removed physically, an inside can be finished flat and smooth, and the man day which manufacture of the metal hollow object which has the weldbonding section takes can be reduced sharply. That is, the removal process of a weld bead or a spatter ball by grinder polish

processing after simple substance buffing for every components becomes unnecessary and unifies is also deleted like before, it is remarkable and compaction of a process is attained. Furthermore, it is, and it carries out and the problem with it difficult [to apply the removal approach by the local grinder of a weld bead and the spatter ball of welding which was the greatest difficulty of the conventional method of construction depending on a configuration] of being impossible is also solved by coincidence.

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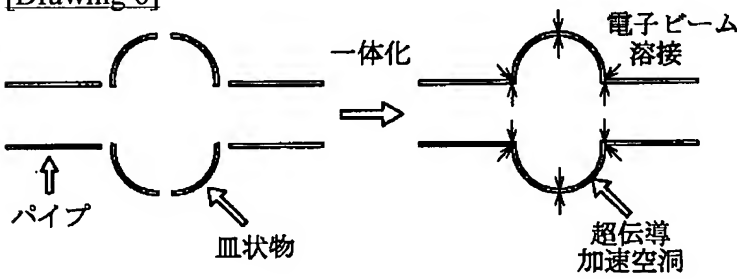
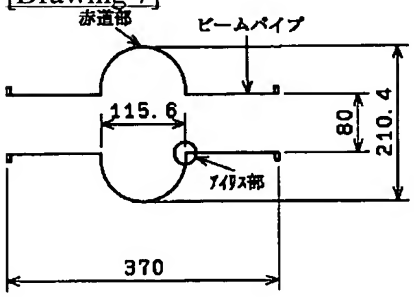
DRAWINGS

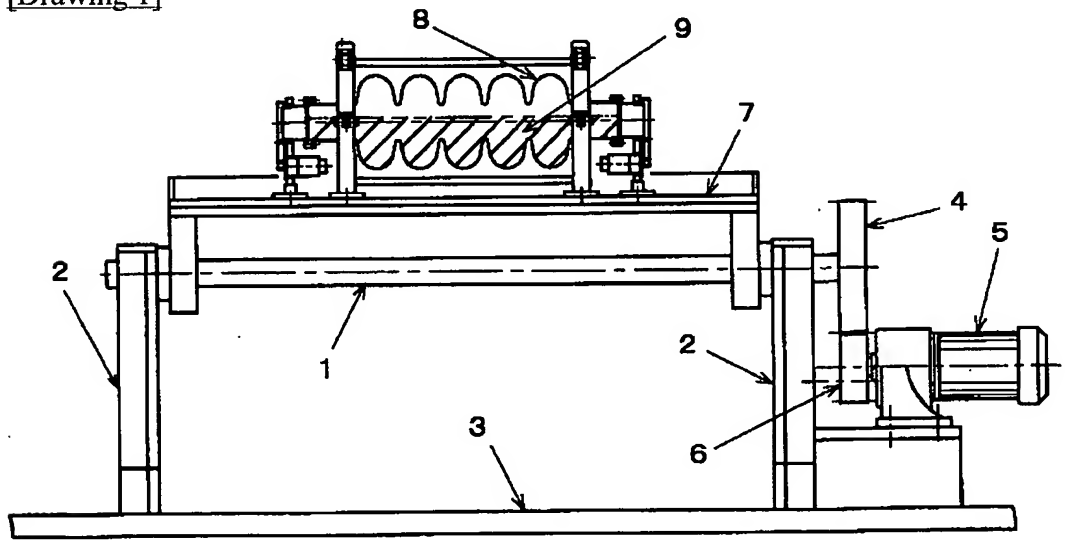
[Drawing 6]



[Drawing 7]



[Drawing 1]



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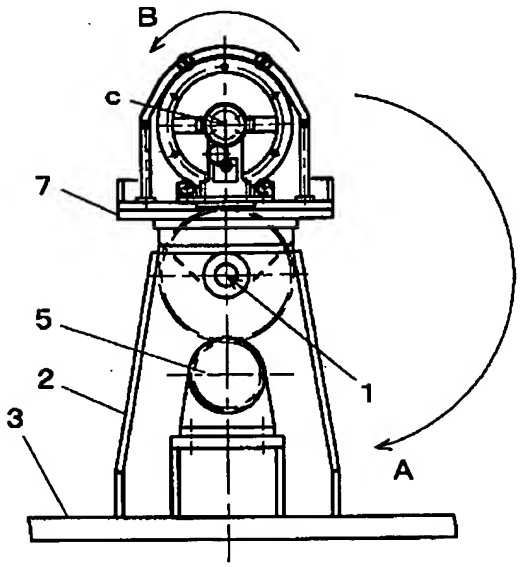

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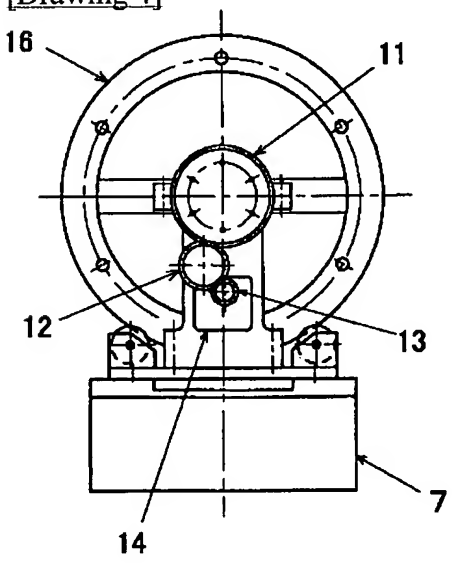

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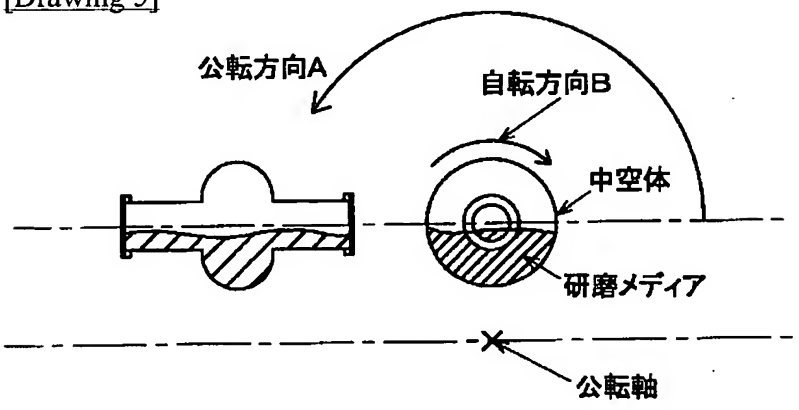

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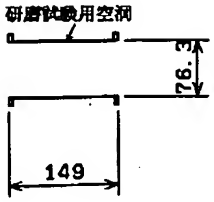
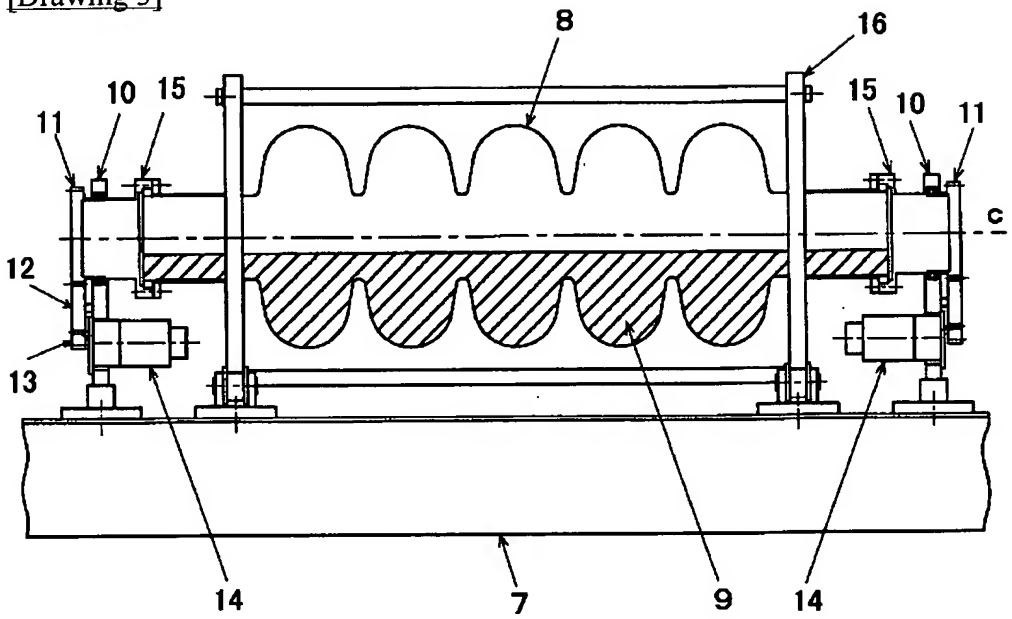


[Drawing 3]



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